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An information circular from the Fiskeriteknologisk forskninginstitutt*

No. 4 - June 1982

The Long-line Fishery of the Future:

MECHANIZATION, SYNTHETIC BAIT, AND NEW HOOK TYPES

by

Åsmund Bjordal

*FTFI News. (FTFI refers to the Research Institute for Fisheries Research)

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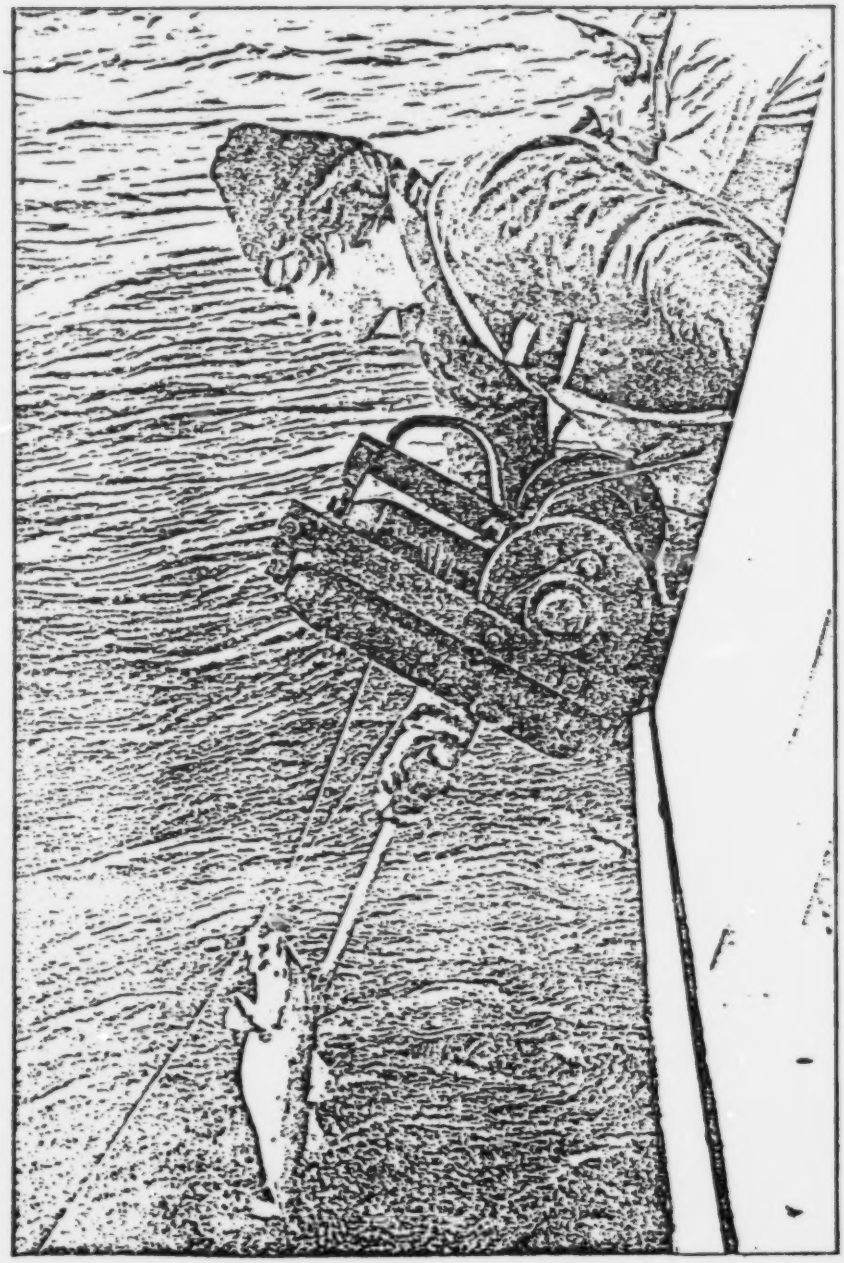


FTFI-NYTT is a supplement to "Rapportsammendrag" (Summary reports). Now, in addition to "Rapportsammendrag" , we also send out FTFI-NYTT.

Rapportsammendrag issues are printed and mailed out to interested persons as soon as a report is complete. Up to now, these issues covered both our own reports as well as provided an overview of data from other agencies. From now on, they will cover only our own data.

In FTFI-NYTT, we will disseminate our results (along with other data) to users in the fishing industry while such results still have news value. FTFI-NYTT will be sent out even if no report has been released. In the issue, it will also be natural to discuss results of interest (from other agencies, both domestic and foreign) which would normally not become known through any of the other industry-related news media.

FTFI is pursuing the following projects in long-line fishing:

- improving catch efficiency and selection in long-line fishing, through perfection of hooks, bait, and rigging;
- baiting and gear handling in the coastal long-line fishery.

In this issue of FTFI-NYTT, we will present some examples of our activity in these long-line projects.

- Synthetic baits
- Bait size
- New hook types
- Mechanization

Synthetic bait

At present the main baits used in long-line fishing are squid and mackerel (in the order of 15,000 tonnes per year), and there is an adequate supply of these species. Based on future projections of the global food situation, however, it is realistic to conclude that we cannot conceivably use food-fish for this purpose to the same extent as we do today.

The development of a synthetic bait for long-lines that is not based on actual food resources will therefore likely be an important trend for future fishing operations.

A synthetic bait must, in addition, possess the following properties:

- be equally effective as natural baits
- be less expensive than today's bait types
- be rational with respect to baiting and storage operations.

In a joint project between the Havforskningsinstituttet (Ocean Research Institute), O. Mustad and Son and FTFI, research has been conducted for several years on the development of an artificial bait. To date, a series of laboratory tests and practical field research have been conducted, with the following main results:

We now have a synthetic bait which appears to be as effective as natural bait for haddock, but for cod, the catch rate using synthetic bait is about 50% compared with standard bait. The synthetic bait consists of 3 main components:

1. Odorant (extract of krill, squid, or mackerel)

2. Carrier agent or filler (guar gel, a substance which dissolves slowly in seawater) and

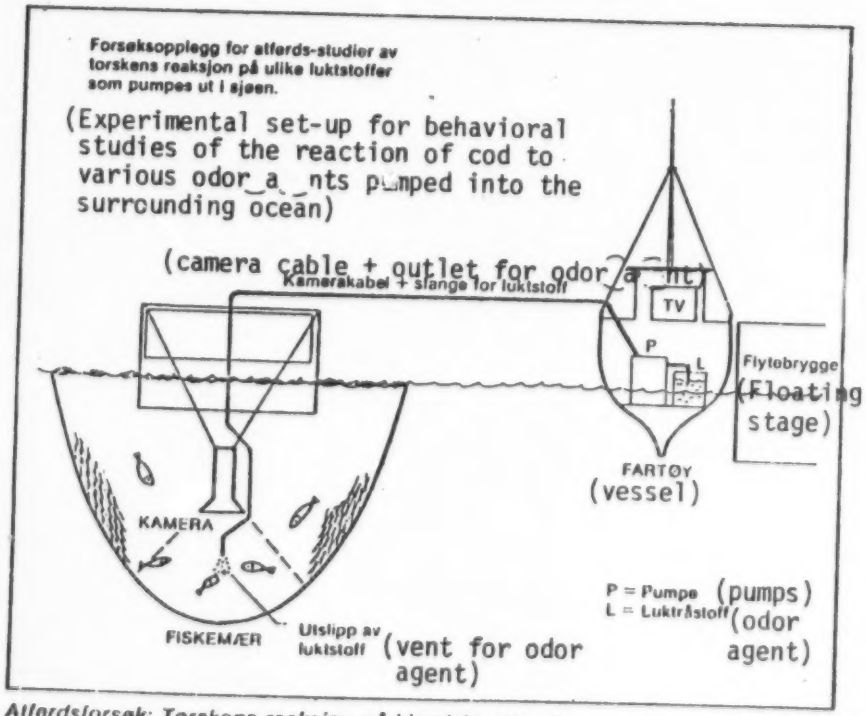
3. Reinforcement (rayon fibre which gives the bait mechanical strength). It is manufactured in ribbon form that can be cut and baited in the usual manner.

Research will continue on this type of synthetic bait based on odorants from natural raw material sources. The goal is, however, to develop attractive odorants which can eventually be synthetized. In connection with this work, chemistry, physiology and studies of fish behavior will be important components.

The main goal of the FTFI project "The reaction of fish to specific chemical stimuli" is to test the appeal of various chemical substances for fish. Earlier behavioural studies have been carried out on cod, in which means were sought of extracting the actual odorants found in mackerel. When these have been extracted, it can then be possible to develop a synthetic bait based on a synthetic odorant. (Figure 1).

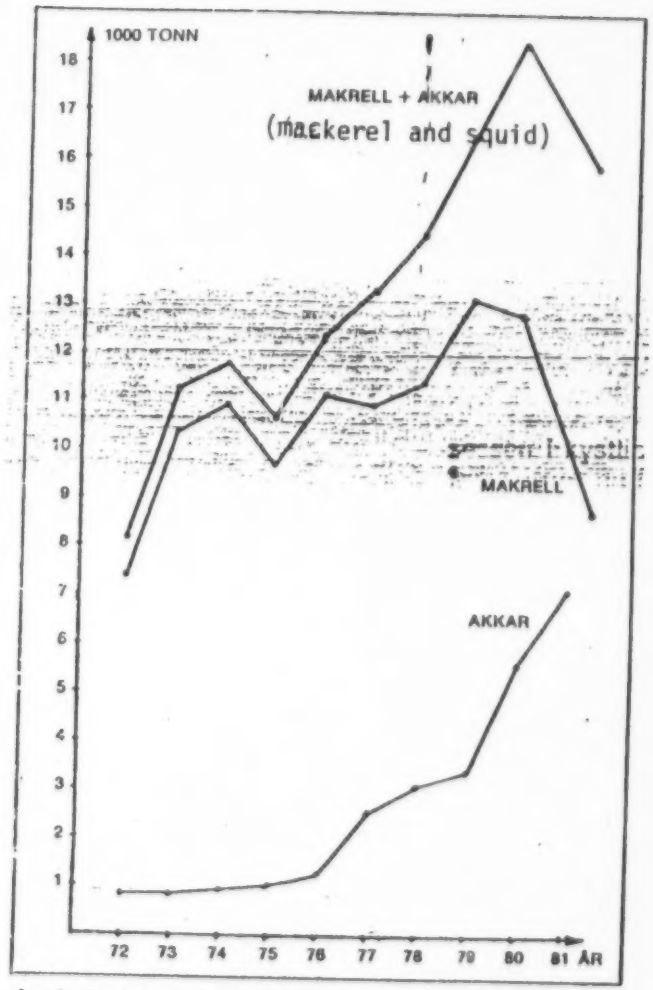
Bait size

What is the optimal bait size in the various types of long-line fisheries? Looking at a bait unit, does it matter whether it weighs 25 or 30 g? The total annual consumption in Norwegian long-line fishing operations is of the order of 500 million bait units (based on 30 g each). Relatively minor reductions in bait size will therefore produce significant savings in total bait consumption.


Forsøksopplegg for atferds-studier av torskens reaksjon på ulike luktstoffer som pumpes ut i sjøen.
(Experimental set-up for behavioral studies of the reaction of cod to various odor agents pumped into the surrounding ocean)
(camera cable + outlet for odor agent)
Kamerakabel + slange for luktstoff
TV
P
L
Flytebrygge
(Floating stage)
FARTØY
(vessel)
KAMERA
FISKEMÆR
Utslipp av luktstoff
(vent for odor agent)
P = Pumpe (pumps)
L = Luktråstoff (odor agent)

Atferdsforsøk: Torskens reaksjon på kjemiske stimuli

(Behavioral experiments: Reaction of cod to chemical stimuli.) Figure 1.



Agnforbruk i norsk linefiske

(Bait consumption in the Norwegian long-line fishery.) Figure 2.

The total bait consumption in the Norwegian long-line fishery is presently 15 - 16,000 tonnes, comprising mainly squid and mackerel (see Figure 2).

To illustrate the effect of reduced bait size on total bait consumption, let us start from a consumption figure of 500 million individual baits . A size reduction of 1 gram per bait will result in a reduction of 500 tonnes in total consumption. The corresponding saving in direct bait subsidies will be 1 - 1.5 million kroner, and, at the same time, the direct bait costs of the individual fisherman will be reduced.

This example must be considered only a preliminary one, but it shows that apparently small reductions in bait size could yield considerable savings on an annual basis.

What would be the effect of such a bait size reduction on fishing success? FTFI has carried out a number of controlled experiments to investigate this question. An example of bait size experiments carried out in the Vardø area showed that a 50% reduction in bait size (10 g) in fact resulted in a significant increase in catch, both for cod and haddock (number of fish). The average length of the fish caught, however, increased somewhat with increasing bait size. However, the research work gave a clear indication that even a considerable reduction in bait size can result in as good a catch as that associated with normal bait sizes (Figure 3).

Similar results were obtained for ling in the Long-Line bank fishery. A supplementary examination of these experiments will therefore be of considerable

importance in order to establish optimal bait sizes, in view of the important consequences this can have for bait consumption and costs.

New hook types

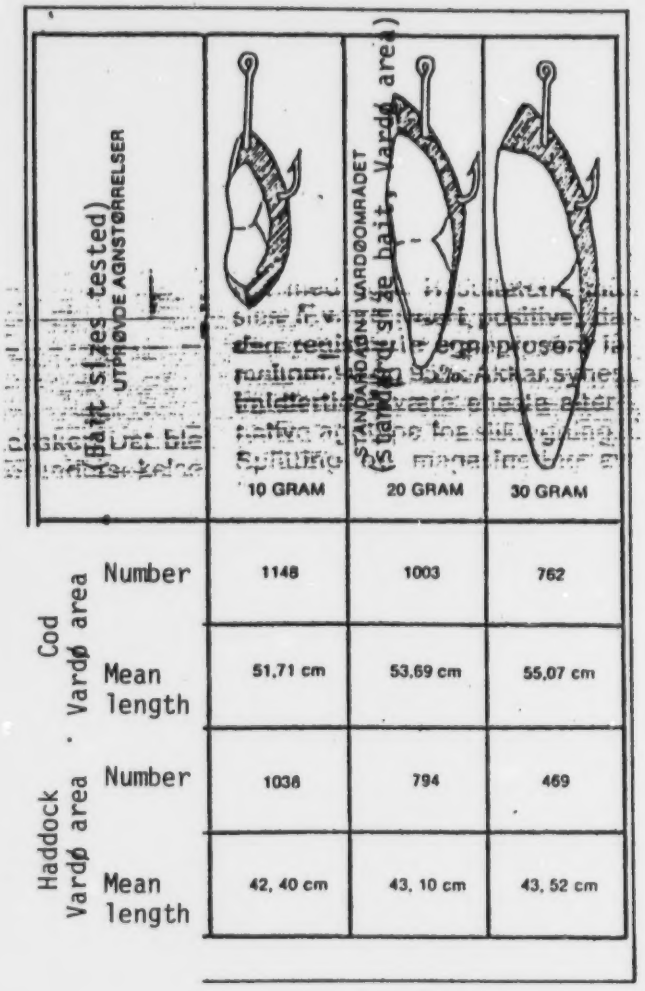
Experiments in bank and coastal long-line fisheries have shown that a number of new hook types have significantly better (up to 90%) hooking probability than traditional types.

So, would the way be clear for considerable catch increases in the long-line fishery if we convert to hook types such as Wide Gap or Doublehook? (Figure 4).

Unfortunately, it is not this simple. Most research results are based on comparable fishing experiments where the line is rigged alternatively with 2 of each hook type (traditional vs. test hook). The fact that double hooks, for instance, yield an extra catch of 90% for ling shows well that it has a significantly better hooking probability than traditional bank line hooks.

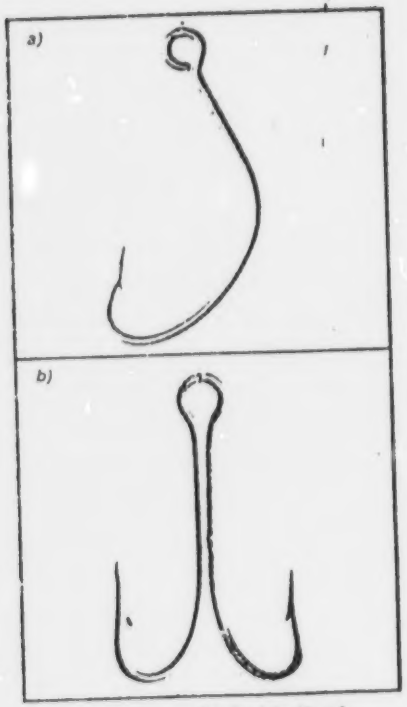
Whether a long-line fishing boat operating on the banks will achieve a high catch increase by converting to double hooks is believed to be highly dependent on fish **density** . In case of low fish **density** , most of the fish attracted to the lines will probably be hooked regardless of whether they are outfitted with "good" or "bad" hooks. The difference lies in the fact that a fish will make far more contacts before it is hooked by a "bad" hook. However, in terms of fishing results, it is not important how many hooks a fish has contacted before it is finally hooked.

At higher fish **densities** (fewer hooks per fish attracted), one must envisage, however, a higher degree of "competition" for the



		10 GRAM	20 GRAM	30 GRAM
Cod Vardø area	Number	1148	1003	762
	Mean length	51,71 cm	53,69 cm	55,07 cm
Haddock Vardø area	Number	1038	794	469
	Mean length	42, 40 cm	43, 10 cm	43, 52 cm

Figure 3. Bait sizes



a) Wide Gap og b) Dobbelkrok

Figure 4. a) Wide gap b) Double-hook

hooks and thus an increased likelihood that a more effective hook will yield a real catch increase.

Mechanization in coastal long-line fishing

Since the war, most types of fishing gear have undergone a significant mechanization and rationalization process. Within the long-line fishery, similar trends have taken place in sections of the bank fishing fleet.

In the coastal long-line fishery, however, little has occurred since the hydraulic winch was introduced. In addition, declining recruitment to the long-line baiting trade has become a serious bottleneck for commercial possibilities in the coastal long-line fishery. Mechanization of the baiting and line-handling process therefore appears to be a prerequisite for future coastal long-line operations.

Because of the above factors, FTFI initiated in 1981 a project aimed at increasing mechanization in baiting and line-handling within the coastal long-line fishery. A survey was first carried out to chart the activity in the area, together with compiling a list of existing solutions related to mechanized line operation. Considerable development activity is proceeding both in Norway and abroad on the subject of long-line mechanization.

To date we have listed over 30 systems, which either are in regular operation or under development.

Three systems were selected for field trials aboard the M/S "Kystfangst"* during the period November/81 to January/82.

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* Coastal Fishery"

1. The Jørgensen - Dahl system. This is a hauling and stowing system for monofilament line in which hooks, gangions and main line are automatically wound onto a drum during retrieval. The field trials were promising, but a variety of deficiencies were uncovered. A new model is presently being developed which is aimed at correcting the weaknesses noted during the trials.

2. Random baiting. This system is based on automatic baiting by passing the line being set out through a chamber filled with bait. The results must be regarded as very positive, since the recorded percentage baited was between 90 and 95 percent. Squid, however, appears to be the only alternative bait for such a technique. Separation and storage of the lines were done manually. Our aim in this regard is to devise a better retrieval and separation system for a planned real-situation test in the fall of 1982. (Figure 5).

3. Gang baiter. This system implies that the hooks are stored in rows along the top of the tub in such a way that it is possible for a single man to bait 320 hooks in 5 minutes. Setting-out of such ready-baited lines went satisfactorily. Line retrieval was the bottleneck in the total operation, however, because with manual line storing it led to unacceptably slow hauling speeds. Work is progressing now on rationalising the storage operation. If an acceptable solution is found, the system will undergo field-testing during the summer / fall of 1982.

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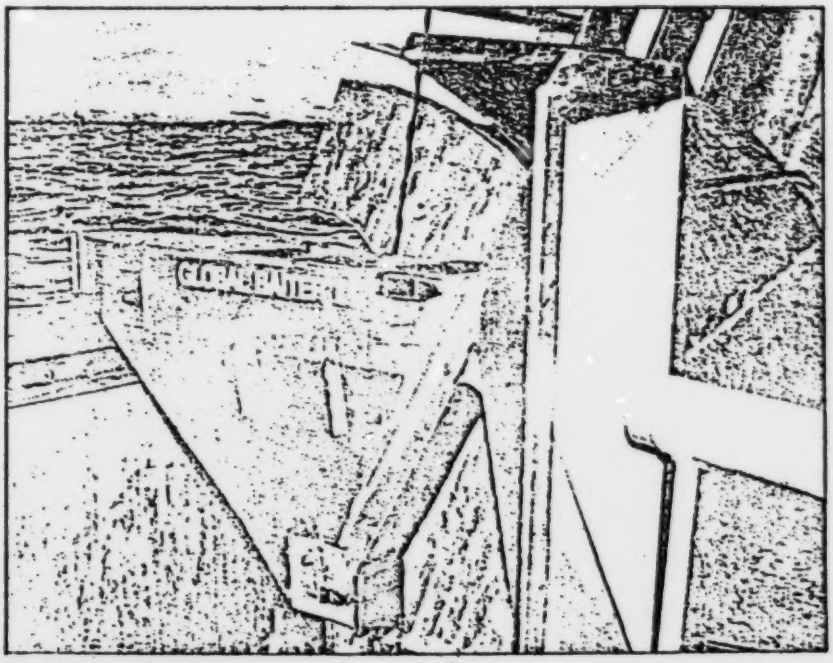

System for tilfeldig egning

Figure 5. System for **random** baiting.

4. The Sari long-line system. In addition, during the spring we have participated in the field testing of a new completely automated long-line system which, in principle, will carry out the same operations as the Mustad Autoline. It is envisaged for smaller vessels (down to 35 feet in length). A field testing of an installation of this type is planned for June / July, 1982.

Two reports will soon be released on the study and operational testing of mechanized long-line systems.